Cholinesterase Monitoring of Pesticide Handlers in Agriculture Report to the Legislature

As required by RCW 49.17.288

JANUARY 2006

Executive Summary

This report is prepared, as required by RCW 49.17.288, to reflect the second year of implementation of the cholinesterase monitoring rule adopted by the Department of Labor and Industries (L&I) in late 2003. [1]

During the 2005 agriculture pesticide application season, 2263 employees participated in baseline (pre-exposure) cholinesterase testing. Six hundred eleven of these employees were tested at least once during the application season (periodic testing). Of the 611employees, 49 (8.0 percent) received at least one test with a 20 percent or greater depression in cholinesterase activity requiring the employer to evaluate pesticide handling practices, and 10 (1.6 percent) were temporarily removed from exposure to cholinesterase-inhibiting pesticides because of a more significant depression. While the number of employees tested remained relatively stable the number of employees with a cholinesterase depression greater than 20 percent in 2005 (59) was half that of 2004 (119).

It is difficult to ascertain specific causes for the reduction in the number of significant cholinesterase depressions. However, the following are thought to have contributed: 1) increased awareness of chemical hazards; 2) improved pesticide handling practices; 3) seasonal pesticide use trends; 4) employer efforts to control hours of exposure; and 5) improved laboratory quality control data collection.

As in 2004, handlers with a depressed cholinesterase levels were employed in the tree fruit industry with operations located in L&I Region 5 in central Washington. Airblast pesticide application was most often implicated in significant cholinesterase depressions. Information on growing operations not participating in the medical monitoring program is not available.

Procedures and requirements for the collection of blood samples did not change for the 2005 season. The Public Health Laboratory continued as the only laboratory approved to provide cholinesterase-testing services. Testing was conducted in accordance with the laboratory Standard Operating Procedures (SOP) established in 2004. All test samples were tested within the time frames established in the SOP. In its analysis of testing services, the cholinesterase Scientific Advisory Committee concluded that testing was well within acceptable parameters.

The rule as adopted requires agriculture employers whose employees handle[2] organophosphate or N-methyl carbamate Category I or II pesticides to keep track of each employees' handling hours and to make available both baseline and periodic laboratory tests to those employees who handle covered pesticides above the threshold in the rule. For the first year, the handling threshold was established at 50 hours during any consecutive 30-day period. As stipulated in the rule the 2005 handling threshold reverted to 30 hours during any consecutive 30-day period.

In adopting RCW 49.17.285, the Legislature required employers to submit pesticide handling hours to the health care provider and laboratory for each employee who received a periodic test. L&I obtained handling hours reports for 912 of the ~ 970 periodic tests given during the 2005 season. The Scientific Advisory Committee did not find a relationship between handling hours and red blood cell cholinesterase activity. Handling hours did have a small relationship with serum cholinesterase activity depression (~1.5% depression for every 30 hours of handling.)

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[1] Rulemaking was initiated pursuant to Juan Rios and Juan Farias v. Washington Department of Labor & Industries, et al., 145 Wn.2d 483, 39 P.3d 961 (2002).

[2] See definitions section 11005 http://www.lni.wa.gov/wisha/rules/agriculture/HTML/part-i-1.htm#WAC296-307-11005

Overall, many of the hurdles present in 2004 had been removed and the program was able to build on last year's experiences. L&I will continue to rely upon the expertise of the Scientific Advisory Committee and the perspectives of the Stakeholder Advisory Committee in implementing the medical monitoring program and in evaluating the rule and its effects.

CHOLINESTERASE MONITORING IN AGRICULTURE

WAC 296-307-148

WASHINGTON STATE DEPARTMENT OF LABOR AND INDUSTRIES

January, 2006

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Background

RCW 49.17.288 directs the Washington state Department of Labor & Industries (L&I) to submit reports of the results of data collection, correlation, and analysis related to cholinesterase monitoring to the legislature. This is the second of these reports with the final report due by January 1, 2007.

A discussion of occupational cholinesterase monitoring and history of the cholinesterase monitoring rule, chapter 296-307-148 WAC, can be found in the Background section of the *2004 Cholinesterase Monitoring of Pesticide Handlers in Agriculture Report to the Legislature* [3]

In 2005 the public health laboratory (PHL) continued to be the sole laboratory approved by L&I to provide cholinesterase-testing services[4]. The PHL had solidified its standard operating procedures (SOP)[5] for cholinesterase testing by the middle of 2004 and additional sample storage and analytical equipment resources were added for 2005. Quality control activities were tightened and included duplicate measurements for every sample run and the use of benchmark control samples run with every sample tray. Laboratory reference ranges were adjusted based on analysis of 2004 baseline results allowing more efficient evaluation of outlier test results. These and other improvements eliminated the start-up challenges experienced in 2004.

The large number of baseline tests received in February and March 2005 resulted in a reporting delay of some baseline ChE results (Table 1). However, all clinical laboratory tests were completed within the 48-hour time frame specified in the SOP. All baseline tests were reported before or along with a periodic test result. The baseline reporting backlog was resolved by the beginning of May.

Test data continued to be collected and managed by the PHL and Department of Health Non-Infectious Conditions Epidemiology program (DOH). DOH maintains the Cholinesterase Monitoring Data System (CMDS), notifies L&I of cholinesterase depressions exceeding 20 percent[6], and provides a variety of data reports. A major 2005 system improvement is that DOH was able to provide L&I with weekly transfers of the entire CMDS data file. This allowed for more efficient overall data management and program oversight.

There were no changes in the cholinesterase monitoring rule from 2004. A few program adjustments occurred as follows:

1. The pesticide handling[7] threshold requiring referral for medical monitoring and testing reverted from 50 to 30 or more hours of handling category I or II organophosphate or N-methyl-carbamate cholinesterase-inhibiting pesticides in any consecutive 30 day period. The reversion to the 30-hour handling threshold is stipulated in section 296-307-14810 of the rule.[8]

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[3] The 2004 SAC report is available at http://www.lni.wa.gov/Safety/Topics/AtoZ/Cholinesterase/files/ChELegRpt2004Final.pdf
[4] Due to laboratory and test methodology variations the use of a single lab and single test methodology allows for the most accurate comparison of test results
[5] Washington State can State Public Health Laboratory Standard Operating Procedures for the Determination of Red Blood Cells and Serum by Ellman Method using Dade Dimension AR Analyzer be obtained from L&I upon request.
[6] Bodies such as the World Health Organization, American Conference of Governmental Hygienists, and the state of California have identified a 20% decrease in cholinesterase activity as indicative of pesticide overexposure.
[7] See definitions section 11005 http://www.lni.wa.gov/wisha/rules/agriculture/HTML/part-i-1.htm#WAC296-307-11005
[8] The 30 hour handling threshold was established upon adoption of WAC 296-307-14520 in 1996. A detailed discussion of the handling hour threshold is contained in the 2004 report to the legislature.

2. As directed under RCW 49.17.285, employers were required to submit the number of pesticide handling hours for each employee to the health care provider and the PHL for the 30 days prior to each periodic test and total for the year. L&I developed a handling hours report form (F413-065-000) and the health care provider submitted a copy of the completed form to the PHL with each periodic test request.
3. In order to avoid any conflicts with RCW 70.02, Medical records -- Health care information access and disclosure, L&I modified the consent form for participation in the testing program to include a statement allowing the health care provider to share employee test results with the employer.[9]
4. L&I immediately verified that the health care provider had notified the employer for each cholinesterase depression that required an employee to be temporarily removed from handling and other potential exposures to cholinesterase inhibiting pesticides. L&I also ensured that the health care provider had scheduled follow up testing for the employee (see WISHA Regional Directive (WRD) 33.27).
5. L&I assigned a designated research investigator to collect field data on employees experiencing cholinesterase depression greater than 20 percent and the growing operations that they work in. Research investigation procedures are detailed in WRD 33.27, Cholinesterase Depression, see Attachment 2.
6. L&I adapted the publication "Jorge's New Job," that describes the cholinesterase monitoring rule and medical testing program, for use in Washington State. English and Spanish language versions have made available to employers and employees at no charge to facilitate program training and outreach efforts[10].

Lowering the pesticide handling threshold from 50 to 30 hours was expected to cause an increase in the number of handlers participating in the monitoring project and, therefore, the number of tests analyzed in 2005; this expectation was not realized. The total number of employees participating in testing decreased from 2630 employees in 2004 to 2263 employees in 2005 while the number of employees with at least one periodic test remained almost the same (580 in 2004, 611 in 2005).

The reduction in baseline testing was most likely a result of L&I actively encouraging employers to judiciously evaluate their handlers' likelihood of meeting the exposure threshold and the experience employers gained in 2004 and thereby reducing unnecessary testing. Other factors such as employer efforts to reduce individual employee handling hours and changing seasonal pesticide use trends are thought to have contributed to stabilizing the testing numbers. L&I continued to reimburse employers for medical service, employee training, and program administration costs through 2005. However, appropriated funds for employer reimbursements were limited and are no longer available; this change in reimbursement may further affect pesticide application practices and testing numbers for 2006.

The Cholinesterase Scientific Advisory Committee (SAC) issued its first report to L&I in March 2005[11]. The report contained a set of preliminary recommendations addressing various program

[9] It is not necessary for employers to know specific cholinesterase test results in order to take the actions required as a result of a percentage change in cholinesterase activity. Specific test results are personal medical information under RCW 70.02 and may not be released without the employee's written authorization.
[10] Copies of "Jorge's New Job: Cholinesterase testing in Washington State" are available from L&I upon request
[11] The Scientific Advisory Committee for Cholinesterase Monitoring: 2004 report to the Department of Labor & Industries is available on the L&I cholinesterase monitoring web page at http://www.lni.wa.gov/Safety/Topics/AtoZ/Cholinesterase/default.asp

elements from specific improvements to laboratory analytical services to overall program evaluation structures. These recommendations and L&I's responses are included as Attachment 1 to this report. The SAC has provided a preliminary 2005 report to L&I and their final report is due by September 1, 2006 (see page 16 for SAC preliminary recommendations.)

Laboratory program

Overview

Laboratory services were a focus of the SAC 2004 report and primary issues included quality control (QC), formalizing Standard Operating Procedures (SOP), unexpected sample volume, and excess sample storage times. Even with these challenges, the SAC otherwise professed a relatively high level of overall confidence in the laboratory program. Recommendations to help ensure continued laboratory quality are contained in Attachment 1.

The following laboratory service improvements were made for 2005:

- The cholinesterase determination SOP was finalized in June 2004 and was used with only slight modifications in 2005
- L&I purchased a second test analyzer to reduce analysis backlog
- Additional low temperature storage was added to increase holding capacity
- Sample rejection criteria [12] were rigidly adhered to resulting in improved laboratory confidence
- Internal and external[13] quality control programs were expanded allowing improved scrutiny of test results and overall program evaluation.
- Necessary staffing patterns were managed in accordance with anticipated sample volumes based on the previous year's experience

With a year of experience and the above program improvements the challenges experienced in 2004 were virtually non-existent in 2005. We commend the PHL for its extraordinary efforts.

Quality Control

The PHL extended its quality control (QC) program in 2005. Laboratory reference ranges were adjusted based on 2004 test data and result acceptance criteria were tightened. Improved QC data allowed for better analysis of laboratory services from 2004.

Blind field QC testing continued during the 2005 monitoring season. A group of approximately 50 non-exposed volunteers, comprised of either L&I staff or medical provider staff, submitted duplicate cholinesterase blood test samples throughout the monitoring season. These samples were submitted to PHL disguised as pesticide handler samples.

SAC analysis of QC data showed good agreement between external (blind samples) QC and internal Laboratory QC data, demonstrating a lack of bias in internal laboratory measurements. Overall data analysis shows good comparability or improvement over 2004 data.

Red blood cell (RBC) cholinesterase analysis remains more difficult to assess than serum (plasma). The lack of a commercially available control material for RBC cholinesterase makes this more difficult. Therefore most QC analysis relies on serum cholinesterase data.

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[12] Sample rejection criteria 1) specimen tube is glass, is different size than specified, or is broken or leaking, 2) specimen is not delivered to PHL within 24-36 hours from time of collection, 3) specimen arrives at PHL at temperature higher than 10 degrees Celsius, 4) specimen is hemolyzed, and 5) minimum patient identification is not provided.

[13] Blind duplicate RBC and serum cholinesterase samples from unexposed volunteers were submitted to the PHL through the monitoring season. Analysis of the external QC data set correlated well with other test data. A detailed discussion of QC data is contained in the 2005 SAC report

A more detailed discussion of laboratory QC issues is contained in the 2005 SAC report to L&I

Laboratory test data analysis

L&I was able to match ~1150 employees who participated in the testing program in both 2004 and 2005. This was accomplished by matching the employee's first name, last name, and birth date and then additional matching of other variable such as employer and mother's maiden name as necessary. In its analysis of these employees' baseline tests the SAC concluded that there is good consistency in overall baseline values between years. The average group difference for RBC cholinesterase is ~6% and the average difference for serum (plasma) ChE is ~1%.

Within person variability was calculated at ~6% for RBC cholinesterase and ~7% for serum (plasma) cholinesterase. Given this relatively small level of variability the SAC concluded that cases of >20% cholinesterase depression were highly reliable: for RBC cholinesterase, at least 81% of alerts were likely to be correct, and for serum (plasma) cholinesterase at least 88% reliable. At the exposure removal level (>30% depression for RBC ChE and >40% depression for serum ChE), both tests were essentially 100% reliable.

The SAC also looked at what potential impact adding a second baseline measurement [14] for each employee would have on the program. Given the number of significant depressions that occurred in the tested population and a calculated within person variability of ~6% for RBC cholinesterase and 7% for serum (plasma) cholinesterase the SAC concluded that adding a second baseline measurement would reduce the false positive rate to about one-third of the rate from a single baseline at the 20% percent cholinesterase depression level. This would result in a reduction of about 3 significant RBC cholinesterase depressions and about 7 serum (plasma) cholinesterase depressions. Now, with a single baseline, the impact of false positives for pesticide handlers at the 20% depression level is that they evaluate their work practices and work place to minimize possible routes of exposure. Adding a second baseline would have no effect at the exposure removal levels (30% depression in RBC cholinesterase and 40% depression in serum cholinesterase.) Given the increased costs and program impacts that adding approximately 2000 more baseline tests would have it does not appear that adding a second baseline would result in overall benefit to the program.

[14] Due to fluctuation in individual's cholinesterase levels some clinical guidelines recommend that baseline measurements be determined as an average of two or more tests taken over a period of days.

Summary of the 2005 Medical Monitoring Experience

As in 2004 the vast majority of employers participating in the medical monitoring program had operations located in L&I Region 5 (West Adams, Benton, Chelan, Columbia, Douglas, Franklin, Grant, Kittitas, Okanogan, Walla Walla and Yakima counties.) Approximately 60 baselines and 2 periodic test were performed outside of Region 5, all in L&I Region 1 (Island, San Juan, Skagit, Snohomish, and Whatcom counties.)

During the 2005 pesticide application season, 2263[15] employees submitted cholinesterase baseline tests. Of those, 1652 employees did not receive any periodic monitoring, presumably (at least in most cases) because their exposure levels remained below 30 hours in any one 30-day period.

Table 1. Monthly blood samples submitted during crop year 2005 (2005 SAC report)

	Baseline		**Periodic (P) Test Number**					
Month	**All Workers**	**Workers with periodic Tests(s)**	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**
Total # Tests	2263	611	611	203	103	25	8	4
January	68	6	0	0	0	0	0	0
February	883	244	0	0	0	0	0	0
March	1064	312	98	0	0	0	0	0
April	113	31	312	6	1	0	0	0
May	91	6	73	83	12	4	1	0
June	23	12	98	61	36	4	3	2
July	23	0	18	28	31	11	1	0
August	0	0	12	24	23	6	3	2
Totals	2263	611	611	203	103	25	8	4

Of the 611 employees who received at least one periodic test, 49 employees (8.0 percent) received at least one periodic test result with a 20 percent or greater cholinesterase depression, requiring the employer to evaluate pesticide handling practices for possible deficiencies. Of those same 611 employees, 10 (1.6 percent) were temporarily removed [16] from exposure due to a

[15] This number (2263) includes baseline tests established by covered pesticide handlers only. Other tests, such as L&I QC testing are not included.

[16] Employees may return to handling covered pesticides when cholinesterase levels return to within 20% of baseline. The cholinesterase levels of 8 of the 10 employees temporarily removed from exposure returned to within 20% of baseline during the season. The remaining two employees did not continue with follow-up testing. While medically removed from exposure to covered pesticides employee pay, seniority and other benefits are maintained at the pesticide handler level for a maximum of 3 months.

more significant depression (at least 30 percent depression in red blood cell (RBC) cholinesterase or at least 40 percent depression in serum (plasma) cholinesterase (Table 2.). The 59 total employees who experienced a significant cholinesterase depression in 2005 worked for 28 different employers.

The numbers and rates of employees experiencing a greater than 20% cholinesterase depression cholinesterase depression (either RBC or serum cholinesterase) was approximately half that from 2004. Factors such as increased awareness of pesticide hazards and greater attention to safety practices are thought to have contributed to the reduction in significant depressions.

Table 2. Comparison of employer and employee cholinesterase (ChE) testing and significant cholinesterase depressions in 2004 and 2005 (2005 SAC report)

	2004	**2005**
Employers participating in testing	380	316
Employees submitting baseline tests	2630	2263
Employees with at least 1 periodic test	580	611
Periodic tests	911	970
Employees with ChE depression to work evaluation level	97 (16.7%)	49 (8.0%)
Employees with ChE depression to exposure removal level	22 (3.8%)	10 (1.6%)

In adopting RCW 49.17.285, the Legislature required employers to submit pesticide handling hours to L&I on each employee who received a periodic test. Handling hours reports were submitted to the PHL through the health care provider with each periodic test request. Reports for 912 of the 970 periodic tests given during the 2005 season were submitted. This is a substantial improvement from the approximately 70% reported in 2004.

The SAC analyzed handling hours in relation to change in cholinesterase levels. No significant relationship was found for RBC cholinesterase. A small relationship was found for serum (plasma) cholinesterase. For every hour spent handling category I or II organophosphate or N-methyl-carbamate pesticides on average a 0.053 percent serum cholinesterase depression could be expected. This would equate with an approximately 1.5% serum cholinesterase depression for every 30 hours spent handling in the 30 days prior to testing.

This indicates that number of hours spent handling cholinesterase inhibiting pesticides is not a good predictor of overexposure. Other variables such as personal protective equipment use, properly fitting respirators, and decontamination practices have a greater influence on exposure than handling hours.

The handling hour threshold for 2006 will remain at 30 hours in any consecutive 30-day period. L&I will revisit this issue after the SAC issue its final report and recommendations in the fall of 2006 (refer to the 2004 Legislative Report for a full discussion of the handling hour threshold).

Employee participation in the testing program

The 2003 Cholinesterase Monitoring Small Business Economic Impact Statement estimated that the declination rate would be approximately 15% [17]. In an attempt to assess the proportion of handlers offered participation in the program but declining testing from the health care provider, L&I surveyed the five health care clinics performing the most baseline cholinesterase tests. Each clinic was asked how many handlers were referred to the clinic and of those, how many declined participation. All clinics had a less than 15% declination rate, well within the expected rates (Table 3.). There are no comparable data for 2004.

Table 3. Declination rates at the five clinics providing the most baseline cholinesterase blood samples. (2005 SAC report)

Provider #	# Baselines submitted	# Workers declining	% Declining
36	559	65	10.4%
42	117	1	>0.1%
37	73	10	12.0%
14	106	14	11.7%
57	701	120	14.6%
Total	1556	210	11.9%

The rule allows employees to either choose to participate or decline participation in the employer's cholinesterase testing program. The option is consistent with other WISHA rules that contain medical surveillance provisions. As an additional protection against potential coercion regarding the employee's decision to participate in the program the rule includes the requirement that this decision is made in conversation with the health care provider. There have been no cases of potential coercion identified. L&I believes adding additional employer requirements and dedicating program resources to track employee declinations is not justified.

[17] Both the Cholinesterase Monitoring Small Business Economic Impact Statement and Cost benefit analysis are available on the L&I cholinesterase monitoring web p-age at http://www.lni.wa.gov/Safety/Topics/AtoZ/Cholinesterase/default.asp

Results of L&I Research Investigations

In 2004, employers with employees who experienced significant cholinesterase depressions were offered an L&I consultation and field evaluation data was collected as part of the consultation process. In 2005, L&I conducted research investigations [18]under RCW 49.17.210. The move to a research based process was made in order to gather more timely and accurate field data, and to allow for broader analysis of this data. In both years employers were notified all of findings (program inadequacies and WAC code violations) and given notification for correction.

For each employee who experienced a cholinesterase depression greater than 20%depression, a designated, bilingual L&I research investigator contacted the affected employer and scheduled a site visit. Specific data was collected on the employee's pesticide handling practices and the employer's pesticide worker protection program. Research investigation procedures and data collection tools are contained in Attachment 2, WRD 33.27 Cholinesterase Depression. In order to increase the quality of data collected over 2004 concerted efforts were made to be on-site as soon as practical after a significant cholinesterase depression was identified. Cholinesterase depressions to the exposure removal level were prioritized. For these cases, the goal was to make initial contact with the employer within two workdays of the research investigator being notified of the depression and to be on-site within 3 days of initial contact. For cholinesterase depressions to the work practice evaluation level the goal was to make initial contact with the employer within one week of the research investigator being notified and to be on-site. Table 4 shows 2004/2005 comparative time frames from employee blood draw to initial on-site research investigation.

Table 4. Time Periods for Selected Steps in Cholinesterase Monitoring System (2005 SAC report)

Time Period Measured	**Performance Goal (Days)**	*2004 Average Time (Days)*	*2005Average Time (Days)*
Baseline Testing			
Blood draw and receipt by PHL	1	1	1
Receipt by PHL to test	1	25	1
Periodic Testing			
Blood draw and receipt by PHL	1	1	1
Receipt by PHL to test	1	1	1
Mailing test report to provider and transferring information to CMDS	3	4	2
Periodic Tests Requiring Work Practice Evaluation			
From test date to L&I informs medical provider	6	6	5
Research investigator notified to site visit	14	35	13
Periodic Tests Requiring Exposure Removal			
From test date to L&I informs medical provider	6	4	4
Research investigator notified to site visit	5	35	9

[18] Summaries of all 2005 research investigations can be obtained form L&I upon request

In contrast with the 2004 experience, in 2005, all performance goals were met or exceeded, except for the number of days between notification of the research investigator and the site visit for cholinesterase depressions requiring exposure removal. This latter activity showed marked improvement over the 2004 performance, but contacting and scheduling site visits with the employer and employee made it infeasible to be onsite within five days.

L&I required that the health care provider confirm notification of the employer in cases of exposure removal. In all cases notification occurred the same day generally within a few hours. Notification was not immediately confirmed for cholinesterase depressions to the work evaluation level. Even with timely research investigations being conducted it is difficult to identify specific causes of overexposure. In many cases, employers appeared to have at least basic programs to protect their employees from pesticide exposure, and it was not always possible to document likely problems that may have directly caused the reported depression. However, the following general observations of factors that may have contributed can be made based on the research information obtained in both 2004 and 2005:

Respiratory Protection

Respirator program deficiencies were the most frequently found WISHA rule violations. The majority of violations involved the lack of an appropriate respirator cartridge change out schedule. Other common violations included failure to provide medical evaluations and appropriate fit testing. The following are examples of potential causes of overexposure identified during research investigations:

- Lack of or inadequate respirator fit testing and employee medical evaluations
- The use of a half-face respirator leaving the skin above and around the respirator opened to contamination.[19]
- Failure to implement an effective respirator cartridge change-out schedule.
- Use of damaged or worn respirators
- Allowing facial hair on tight-fitting respirator users
- Failure to decontaminate respirators after use and store respirators appropriately

Other Personal Protective Equipment (PPE)

The majority of PPE rule violations found involved not wearing appropriate chemical resistant headgear when required by the pesticide product label. Other common violations related to failure to clean and decontaminate personal protective equipment. The following are examples of potential causes of overexposure identified during research investigations:

- Not cleaning and decontaminating personal protective equipment after each use, incl. meal and bathroom breaks.
- Wearing cotton baseball style cap or hooded sweatshirt under protective headgear. The cap or sweatshirt may become contaminated or saturated while spraying.
- Wearing cotton gloves under protective gloves.
- Not using personal protective equipment specified on the pesticide product label
- Not wearing gloves and other appropriate PPE while unclogging and cleaning sprayer nozzles.

[19] Half-face respiratory protection complies with the pesticide labeling requirements.

Decontamination

The following are examples of potential causes of overexposure identified during research investigations:

- Not washing face and hands thoroughly and immediately after application and when going on breaks or for lunch.
- Not changing clothes after pesticide application
- Showering at home after pesticide application
- Not wearing appropriate PPE during equipment decontamination.
- Not following defined equipment decontamination procedures

Involved Crops and Application Methods

As in 2004 employees with significant cholinesterase worked in the tree fruit industry.[20] With the exception of one employee who functioned as a pesticide spray manager all employees with cholinesterase depression in 2005 applied covered pesticides by airblast sprayer. All significant cholinesterase depression occurred in L&I Region 5 which is composed of Okanogan, Chelan, Douglas, Kittitas, Grant, Yakima, Adams, Franklin, Benton, Walla Walla, and Columbia counties.

As research investigations were confined to only those employers with an employee who had experienced a significant cholinesterase depression there is no information available on other employers, both participating and not participating in the cholinesterase monitoring program.

Pesticide-Specific Observations

The majority of significant cholinesterase depressions occurred during the beginning of the tree fruit application season (dormant season spraying). Later depressions tended to coincide with orchard activities such as application of fruit thinning and post bloom cover sprays. During dormant season spraying, the organophosphate insecticide Lorsban™ (chlorpyrifos) is used. The fact that the majority of significant cholinesterase depressions were due to depression of serum cholinesterase is consistent with the use of chlorpyrifos as it has an affinity to bind with serum cholinesterase.

Guthion (azinphos-methyl) remains the most widely used cholinesterase inhibiting pesticide and was handled by employees in 20% of cases of significant depression. Other cholinesterase inhibiting pesticides handled by these employees were Carzol™ (formetanate hydrochloride) and Imidan™ (phosmet.)

[20] The pattern of blood sample submittals corresponded to the use of covered insecticides during a time when fruit trees are in dormancy or have very little canopy... The timing of these periodic tests corresponds closely to dormant season spraying followed by pome fruit thinning sprays and spraying for the first generation flight of codling moth (2005 SAC report).

The 2006 monitoring program

In general the cholinesterase monitoring program will remain unchanged for 2006. The program functioned effectively in 2005 and any major evaluation or assessment of the rule will not occur until after the 2006 pesticide application season when the final report from the Scientific Advisory Committee (SAC) will be issued. Program and rule issues of interest for 2006 are as follows:

Laboratory services

The PHL has agreed to provide testing services through 2006 and will remain the only approved laboratory. This decision was made in order to provide continuity through the rule evaluation period as well as to allow sufficient time to consider how to provide for laboratory services in 2007.

Originally, PHL only agreed to provide testing services through 2005 based on workload at the laboratory and agency mission. In order for PHL to provide services through 2006 and also meet its other obligations, L&I will hire a non-permanent Chemist 3 to help manage the testing program at the PHL. Temporary laboratory staff will be utilized as necessary during high volume periods. The PHL and DOH will continue to provide administrative and information technology support staff for the laboratory and Cholinesterase Monitoring Data System (CMDS) programs.

The PHL and the SAC will continue working with L&I to develop an effective plan for laboratory testing services and ongoing quality control monitoring. Recommendations from the SAC are contained in the 2005 report to L&I.

Research investigations

Rule section 296-306-148 provides for analysis of data collected during the 2004 and 2005 pesticide application seasons. In order to collect relative data on affected pesticide handlers, growing operations, and pesticide handling practices L&I conducted field data collection activities through WISHA consultation services in 2004 and assigned a dedicated research investigator in 2005. These activities are detailed in WRD 33.27.

Since there is no present need to continue to collect field data (the SAC will continue to analyze 2004/05 data for its final report) research investigations will not continue in 2006. The rule, as with all other WISHA rules, will be supported through WISHA's compliance and consultation services. Employer participation and employee cholinesterase testing will continue to be collected and monitored by L&I and DOH. Consultation and investigation activities may be assigned based on survey of laboratory test reports and through the routine complaint and request for consultation processes.

Employer cost reimbursements

With the aid of legislative appropriations in 2004 and 2005, L&I was able to reimburse agriculture employers for costs associated with cholinesterase monitoring clinical services, training and program administration costs. These reimbursements were provided as part of the initial rule evaluation period and to lessen the initial economic impacts of the rule. Beginning in 2006, and as stipulated in RCW 49.17.240, medical monitoring costs will begin shifting to the employer.

L&I will continue to subsidize all laboratory test costs in 2006. This will include all laboratory tests, and related personnel and administrative costs. Beginning in 2007, these costs are expected to be shifted to the employer.

Rule amendments

L&I has adopted rule changes for 2006 based on stakeholder recommendations and to address program changes occurring since original rule adoption, Attachment 3. The rule will become effective on February 1, 2006. The following summarizes rule changes for 2006:

- WAC 296-307-14805 – Currently there is a requirement in RCW 49.17.285 which requires employers to provide handling hours to the medical provider/laboratory, this language has been added to the rule.
- WAC 296-307-14810 – Removed references to the 50 hour handling threshold in place only in 2004.
- WAC 296-307-14815 – Added a requirement for the employer to obtain a written recommendation from the health care provider for all blood testing and evaluations and to ensure the employee is provided a copy of the recommendation within 5 days of receipt. This will ensure that employees receive the same information from the medical provider that the employer receives.
- WAC 296-307-14815 – Removed the statement allowing the employer access to an employee's test results without specific written authorization. Clarified that the health care provider's written recommendation may include changes in cholinesterase levels but not actual test results. This is consistent with the protections contained in Chapter 70.02 RCW, Medical records -- Health care information access and disclosure.
- WAC 296-307-14830 – Clarified the medical removal protection requirements by including examples of how employers would retain employee wages.

The Scientific Advisory Committee (SAC)

Committee Members

The SAC, created in February of 2004, is chaired by Dave Kalman, PhD, who heads the University of Washington's Department of Environmental and Occupational Health Sciences. The remaining members of the committee include the following:

- Dave Bonauto, MD, Associate Medical Director of the Department of Labor and Industries, Safety and Health Assessment for Research and Prevention Program
- Rupali Das, MD, MPH, California Department of Health Services
- Allan Felsot, PhD, Washington State University Extension Specialist and Environmental Toxicologist
- Matthew C. Keifer, MD, MPH, Associate Professor of Environmental and Occupational Health Sciences, University of Washington
- Michael O'Malley, MD, MPH, Staff Physician with UC Davis Employee Health Services and consultant to the California Department of Pesticide Regulation's Worker Health and Safety Branch
- Steven Smith, MD, MPH, Contract Medical Director at Umatilla Chemical Disposal Facility, employed by Washington Defense Company, a subsidiary of Washington Group International, Inc.
- Juliet VanEenwyk, PhD, State Epidemiologist for Non-Infectious Conditions, Washington State Department of Health
- Gerald van Belle, PhD, Professor of Biostatistics and Environmental and Occupational Health Sciences, University of Washington
- Barry Wilson, PhD, of the Department of Environmental Toxicology at the University of California, Davis

2005 draft SAC report recommendations

The SAC provided a draft report based on the available data from the second year's experience to L&I and to the Stakeholder Advisory Committee on December 2nd. The report contains detailed analysis of test data and program performance along with recommendations for continued improvement. The final SAC report will be available by mid January. Preliminary SAC recommendations are as follows:

1. *Matching of periodic and baseline test by worker*

   This time-consuming and potentially error prone process could be corrected by the issuance of unique identifiers to participating workers. Such modification is likely to be more important in the future when the program is self-supported and resources for L&I program evaluation become more scarce.

2. *Select and implement procedures to assure timely communication of ChE test results to the pesticide handler.*

   As a medical standard of care, notification to a patient of their laboratory test results is incumbent upon the health care provider. Other suggestions to improve notification of workers of their ChE results include requiring the employer to inform the worker or to contract with a health care provider who will agree to inform the handler of his or her test results

3. *Laboratory services*

   The Scientific Advisory Committee suggests that L&I have extensive interaction with both the SAC and the Stakeholder Advisory Committee in managing program transitions from 2006 to 2007, including contracting with a private laboratory for ChE testing, discontinuation of subsidized ChE laboratory testing and program maintenance expenses, and significant potential disruption in the assistance provided by state agencies to data flow for the ChE monitoring system

   The PHL should develop and use a formal QC checklist as part of data validation.

   The PHL is encouraged to maintain the procedural and organizational improvements adopted between 2004 and 2005.

   Determining the longer-term role of the PHL in this monitoring program is highly desirable if the lab is to make strategic plans to develop this assay further.

   Inter-lab exchanges and development of a robust control material for RCB ChE is still needed.

   Modification of the sample submission form and/or improved provider training to avoid confusion over pesticide handling prior to collection of baseline samples is recommended.

4. *Baseline testing*

   The Scientific Advisory Committee does not recommend adding a second baseline test to the Rule requirements, based on apparent benefits estimated from 2005 data.

5. *Employee program participation*

   No recommendation

6. *Cholinesterase depression follow-up*

   Continue to improve timeliness in alert follow-up, particularly in the number of days between notification to the research investigator and the site visit for ChE depressions to the exposure removal level.

7. Pesticide illness identification

If a worker has an established baseline within the ChE monitoring program, the SAC recommends that health care providers be permitted to submit samples to the PHL following an acute exposure that leads to symptomatic illness.

The Stakeholder Advisory Committee

Committee Members

The Stakeholder Advisory Committee was created in January 2004. Its members include the following:

- Jim Jesernig, Jesernig & Coyne, on behalf of the Washington Potato Growers *(grower representative)*
- Kirk Mayer, Washington Growers Clearinghouse *(grower representative)*
- Erik Nicholson, United Farmworkers *(farmworker representative)*
- Evi Licona, Columbia Legal Services, on behalf of her clients *(farmworker representative)*
- Matthew Keifer, MD, MPH, University of Washington *(farmworker-designated scientific member)*
- Allan Felsot, PhD, Washington State University *(grower-designated scientific member)*
- Dorothy Tibbetts, Manager, Pesticides & Surveillance, DOH
- Ann Wick, Pesticide Program Manager, Washington State Department of Agriculture (WSDA)
- Nathan Lacy, PhD, Director, Environmental Laboratory Services, Washington State Public Health Laboratory

L&I appreciates the work of the Scientific Advisory and Stakeholder Committees and thanks their respective employers for making them available to assist in evaluating the rule and its implementation.